PREPARE YOUR HOSPITAL FOR FUTURE CRISES WITH STRATEGIES LEARNED FROM COVID-19

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As the COVID-19 pandemic took hold in the U.S., many in the AEC industry were focused on helping healthcare clients implement their emergency preparedness plans for the projected patient surge. As a result, many steps have been taken to expand the capacity of the nation's healthcare infrastructure. This has included modifying patient rooms to negative pressure, evaluating medical gas capacity, building temporary triage facilities, and modifying hotels and convention centers for alternate care sites.

The industry will likely see new regulatory requirements that will greatly impact the planning and design of healthcare facilities to ensure they are prepared for future pandemics. Such planning can begin now, however, by reviewing the lessons learned to date from the responses to COVID-19 and discussing design strategies that provide the most flexibility for healthcare systems.

Patient room design

ICU-ADAPTABLE BEDS

The potential shortage of ICU beds has been a common concern during the COVID-19 crisis. ICU beds are intended for patients with life-threatening health problems who require close and constant monitoring. Many of these patients, including the most critical COVID-19 patients, require ventilators and other specialized equipment and care of the ICU.

From an infrastructure standpoint, ICU beds require additional medical gases, electrical outlets, and nurse call devices compared to the code minimum requirements for a traditional medical/surgical (med/surg) bed. The most numerous in any hospital, med/surg beds are designed for patients with a wide range of illnesses but who may not require as many medical interventions as an ICU patient.

Therefore, when a patient surge occurs, therefore, hospitals run the risk of not having enough ICU beds to treat those in need of intensive care.

Future design consideration: Provide either a dedicated med/surg patient floor or a certain number of med/surg patient rooms with the same code-required infrastructure (electrical, medical gas, nurse call) to support an ICU patient should a patient surge occur. (See chart below.) This may not result in substantial additional cost to the healthcare organization since many med/surg user groups request a quantity of outlets similar to the number found in an ICU and the fact that many health systems have committed to a "universal room" design.

CODE REQUIREMENTS FOR HOSPITAL BEDS

	Electrical	Medical Gas			Nurse Call		
	Number of single receptacles	Oxygen	Vacuum	Medical Air	Patient Station	Staff Assistance Station	Emergency Call Station
Medical/Surgical Patient Bed	12	1 / BED	1 / BED	–	✓	✓	✓
ICU/Critical Care Patient Bed	16	3 / BED	3 / BED	3 / BED	✓	✓	✓

Note: Minimum requirements in accordance with FGI Guidelines for Design and Construciton Hospitals: 2018 Edition

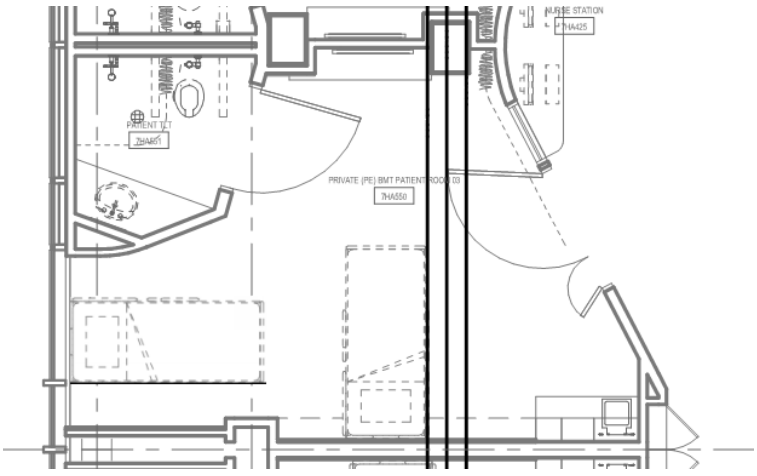
ADAPTABLE PRIVATE ROOMS

Another challenge during the pandemic has been the potential shortage of non-COVID 19 patient beds. Alternate care site conversions of hotels, schools, and convention centers have been evaluated, and in some locations employed, to prepare for such shortages. This option typically is considered a last resort due to cost, time to implement, and, most importantly, the risk of serving a high-acuity patient in an unfamiliar location without all the safety provisions commonly found in a healthcare facility.

Future design consideration: Provide a dedicated med/surg patient floor or a certain number of med/surg private patient rooms with the infrastructure to be easily adapted to a semi-private room during an emergency. (See drawing at right.) These would be considered non-licensed beds and would only be available to low-acuity patients during a patient surge crisis to temporarily increase the quantity of beds within the hospital.

The electrical, medical gas, and nurse call infrastructure to support an additional patient bed could be placed in a recessed headwall or other concealment system to provide easy access.

Pre-Op/PACU spaces also can be easily adapted to patient bed space during an emergency by implementing strategies in the HVAC system to allow them to become 100 percent outside air and/or negative pressure to the surrounding spaces.



HVAC design and distribution

As part of their disaster preparedness plans, many health systems began looking for ways to modify their HVAC system to support their infection control efforts as COVID-19 continued to spread. Common strategies included improving indoor air quality by increasing air handling units (AHUs) to 100 percent outdoor air and drawing patient rooms or entire departments to negative air pressure to support containment measures. Outside air conditions, infrastructure capacity, and ease of modification have made some of these measures more effective and easier to achieve, depending on the facility.

Regulatory mandates will likely have an impact on the quantity of airborne infection isolation (AII) rooms required in future designs. However, healthcare systems will be looking to the design community for options that balance system flexibility, first cost, and operating cost to best prepare them for emergencies.

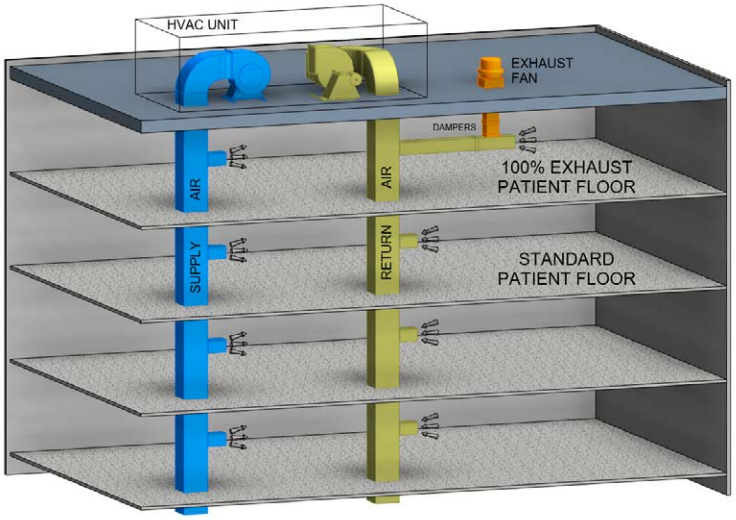
Future design consideration: Carefully evaluate AHU zoning for patient bed floors. Consider having a dedicated patient floor or a portion of a patient wing designated as an "emergency non-recirculation" space. During an emergency, an exhaust fan would be enabled to draw the patient floor to negative pressure and motor-operated dampers would modulate to deny air from being recirculated to the central air handling station. (See drawing at right.)

Emergency Department

Since the emergency department is the entry point for patients seeking immediate care, it has been a challenge to institute measures that separate patients with COVID-19 symptoms from those in need of critical emergency care.

Many health systems have constructed temporary triage tents to separate suspected COVID-19 patients from the main hospital while they are screened. If the screening determines additional care is required, the patient is then admitted into the main hospital. This additional level of triage has proven successful in providing greater protection for staff and patients.

Future design consideration: Carefully evaluate AHU zoning for the emergency department and consider serving the space with a dedicated AHU that is 100 percent outdoor air



or at a minimum has the capacity and capability to operate in a purge cycle. Under the purge cycle, the AHU can operate at 100 percent outdoor air with no recirculation during an extended emergency. Provide the appropriate controls and testing to ensure switch-over is easily obtained, and size heating and cooling system capacity as appropriate for the location.

Due to leakage potential, exhaust air from an emergency department should not be used for an energy recovery system.

Other ED considerations include:

- Designating several ED exam/treatment rooms as negative pressure rooms or to have the ability to be converted easily. (Emergency department waiting rooms are required by code to be designed with a negative air pressure.)

- Adding emergency domestic water hook-ups in the ambulance bay or outside of the ED to allow these spaces to serve as additional decontamination areas should there be a need for mass patient decontamination triage. A similar approach would be to consider additional emergency hooks-ups (power, medical gas, etc.) to support a longer-term triage overflow.

Emergency department exam rooms that can be converted to negative pressure can be used to separate patients with COVID-19 symptoms from those in need of critical emergency care.

Conclusion

While there may be the temptation to go to extreme measures to mitigate future virus transmissions, it is critical for the AEC industry to develop design strategies that balance risk, cost, and flexibility in the quest to help healthcare clients best prepare for future pandemics.

The design considerations outlined in this paper provide a good foundation for preparing a healthcare facility for future patient surges.

However, these strategies likely represent only the beginning of future changes to healthcare design as a result of COVID-19. Therefore, as the pandemic continues and more lessons are learned, IMEG will update this document and provide additional resources for healthcare clients.

For more information about these and other post-COVID-19 healthcare design strategies, contact the authors.

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